

CLAIMS

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- Sub B6
- 5 1. A method for producing a plastic film, the method comprising extruding a plastic film (5) and orientating it, **characterized** in that before extrusion material is mixed into the plastic (5a) of the plastic film (5), cavitation bubbles are formed in the plastic (5) film to be stretched due to the influence of the material, after extrusion the plastic film (5) is orientated by stretching, and simultaneously with orientation pressurized gas is arranged to act on the plastic film (5) so that the gas diffuses in the cavitation bubbles, and thus bubbles (25) containing gas are formed in the plastic film (5).
- 10 2. A method according to claim 1, **characterized** in that gas is arranged to act on the plastic film (5) at the first orientation stage and thereafter the plastic film (5) is subjected to a second orientation which is substantially perpendicular to the first orientation so that the bubbles (25) containing gas expand due to the influence of the second orientation and the gas.
- 15 3. A method according to claim 2, **characterized** in that at the first orientation stage the plastic film (5) is orientated in the machine direction and at the second orientation stage the plastic film (5) is orientated in the direction substantially transverse to the machine direction.
- 20 4. A method according to ^{claim 1} ~~any one of the preceding claims~~, **characterized** in that the pressure of the gas acting on the plastic film (5) is over 3 bars.
- a 25 5. A method according to ^{claim 1} ~~any one of the preceding claims~~, **characterized** in that before extrusion an oily substance or a substance having a melting point lower than the orientation temperature of the plastic (5a) is mixed into the plastic (5a).
- 30 6. An apparatus for making a plastic film, the apparatus comprising an extruder (1) and at least one orientation device (12, 17) for orientating the extruded film (5), **characterized** in that the apparatus comprises gas supply means (15, 16) arranged in at least one orientation device (12, 17) for feeding pressurized gas into the plastic film (5) simultaneously with orientation by stretching so that the fed gas diffuses in the cavitation bubbles that are formed in the plastic film (5) during stretching, and thus bubbles (25) containing gas are formed in the plastic film.
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7. An apparatus according to claim 6, **characterized** in that the gas supply means (15, 16) are arranged in the first orientation device (12) and that the apparatus comprises a second orientation device (17) after the first orientation device (12) in the direction of the plastic film (5), the second orientation device (17) being arranged to orientate the plastic film (5) in the direction substantially transverse to the orientation direction of the first orientation device (12) so that the bubbles (25) containing gas expand due to the influence of the second orientation device (17) and the gas.

8. An apparatus according to claim 7, **characterized** in that the first orientation device (12) is arranged to orientate the plastic film (5) in the machine direction and the second orientation device (17) is arranged to orientate the plastic film (5) in the direction substantially transverse to the machine direction.

9. An apparatus according to ^{claim 6} ~~any one of claims 6 to 8~~, **characterized** in that the gas supply means (15, 16) comprise a discharge chamber (15), in which case at least one orientation device (12, 17) is arranged inside the discharge chamber (15) so that the pressure of the gas in the discharge chamber (15) acts on both sides of the plastic film (5) simultaneously with the orientation effect of the orientation device (12, 17).

10. An apparatus according to ^{claim 6} ~~any one of claims 6 to 9~~, **characterized** in that the extruder (1) comprises a nozzle (6) which is arranged to widen up to the end portion of the extruder (1).

11. An apparatus according to ^{claim 6} ~~any one of claims 6 to 9~~, **characterized** in that the apparatus comprises a cross-direction orientation device (17), which comprises two orientation wheels (18) and endless orientation bands (19) which are arranged against the wheels and move around band guide rolls (20), both edges of the plastic film (5) to be orientated being arranged between the orientation wheel (18) and the orientation band (19) and the orientation wheels (18) and the orientation bands (19) being arranged so that in the direction of the plastic film (5) they are further away from one another at the end than at the beginning, in which case the cross-direction orientation device (17) stretches the plastic film (5) in the cross-direction.

12. An apparatus according to claim 11, **characterized** in that the apparatus comprises a curved support plate (21), which is arranged between the orientation wheels (18) to support the plastic film (5).

13. An apparatus according to claim 12, **characterized** in that the support plate (21) is provided with gaps (21a) and heated gas is arranged to flow through the gaps to heat the sliding surface of the support plate (21) and plastic film (5).

5 14. A plastic film, which comprises bubbles (25) with the maximum diameter of about 100 micrometers and the maximum height of about 10 micrometers, **characterized** in that material is mixed into the plastic (5a) of the plastic film (5), cavitation bubbles are formed in the stretched plastic film due to the influence of the material and the plastic film is subjected
10 to stretching and to pressure of pressurized gas simultaneously with stretching so that the bubbles (25) contain said gas, the foaming degree of the plastic film (5) being over 70%.

15 15. A plastic film according to claim 14, **characterized** in that an oily substance or a substance having a melting point lower than the orientation temperature of the plastic (5a) is mixed into the plastic (5a) to provide the cavitation bubbles that are formed during stretching.

16. A plastic film according to claim 14 ~~or 15~~, **characterized** in that the plastic film is made of polymethylpentene (TPX).

20 17. A plastic film according to claim 14 ~~or 15~~, **characterized** in that the plastic film (5) is made of cyclic olefin copolymer (COC).

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